

Chapter 4

Calculating Acceptable Separation Distances

This chapter will more clearly define the types of tanks (or containers, used interchangeably throughout) and provide worksheets (nomographs) and instructions for calculating the acceptable separation distance (ASD) for various hazards from a proposed site. Also included is guidance for deciding which container to use when making ASD calculations, and an example of a potential site problem (See Appendix E).

Prior to discussing methods for calculating and evaluating separation distances between the proposed site and hazardous operations, the Guidebook discusses containers and basic guidelines for selecting which one to use for the ASD calculation.



Types of Containers

Hazardous chemicals, flammable liquids, and liquefied gases are generally stored in above ground tanks. Storage tanks for such products can be classified into these basic categories:

1. Pressurized tanks (or containers)
2. Unpressurized tanks
3. Natural gas holders with floating tops
4. Buried tanks
5. Tank trucks or railroad tank cars (tanks used to transport substances rather than just storing them)
6. Compartmentalized seagoing vessels, barges and tankers

When calculating the acceptable separation distance (ASD) for any container, the type container involved will provide some information on whether or not ASD must be calculated for either thermal radiation (fire) or blast overpressure (explosion) or both. Consider the following:

- **Pressurized tanks** store gaseous material in liquefied form. Chemicals and petroleum products stored in pressurized tanks are both explosive and flammable; therefore, the ASD must be determined for both blast overpressure (explosion) and thermal radiation (fire).

- **Unpressurized tanks** store liquid petroleum products or other liquid products of a flammable nature. The absence of pressure generally eliminates the need for an ASD calculation for blast overpressure. For unpressurized tanks, calculate the ASD for fire (thermal radiation) only.

- **Natural Gas Holders with Floating Tops** store natural gas. Fires or explosions involving natural gas holders are relatively rare. In cases where natural gas holders have involved fire, they have been limited to vents and points of tank rupture. Statistics and experience have demonstrated that such fires have had little effect on the surroundings. Therefore, it is an acceptable assumption that fires in gas holders will present no hazardous consequences to nearby housing. For natural gas holders with floating tops there is no need to calculate an ASD from a proposed project site.

- **Buried Tanks** are not considered to be a hazard.

- **Tank trucks and railroad tank cars** are used for transporting hazardous petrochemicals or petroleum products. For the purpose of the Guidebook tank trucks and railroad cars are not considered.

- **Compartmentalized Seagoing Vessels and Tankers (and Barging Operations)** are not covered by the regulation or guidebook.

There are two additional factors about tanks which influence the calculation of the ASD and its accuracy: whether the tanks are diked or not diked and from which point on the tank do you take measurements.

Factor 1. For diked (see Chapter 2 for definition) tanks the ASD will be calculated by using the square footage of the diked area.

Factor 2. Always measure from the center of the tank, not the perimeter.

An abbreviated guide to container type and potential hazard is charted below.

Guide to Potential Hazards

Container	Potential Hazard
Pressurized storage tanks	explosion (blast overpressure) and fire (thermal radiation)
Unpressurized storage tanks (diked/undiked)	fire
Natural gas holder with floating tops	none
Tank trucks/railroad tank cars (when servicing a stationary facility)	fire (if products are flammable liquids), and explosion (if products are compressed/liquefied gas)

It should be stressed that while information regarding the type of tank, i.e., pressurized or unpressurized, and basic data requirements (Chapter 3 and Appendix C) pertaining to the site provides most of the factual data need for calculating the ASD, a person must still decide which container to select in making the ASD calculations. The Guidelines for making that selection follow.

Basic Guidelines for Deciding Which Container(s) to use in Making ASD Calculations

1. When one container of any size is located in such a way that it presents a potential threat to a project site, the separation distance must be evaluated for that container.
2. When there are two or more containers of the same size or two or more diked areas of the same size, the separation distance need be evaluated only for the container or diked area closest to the site.
3. When two containers or two diked areas of different sizes expose a site and the larger container or the larger diked area is closer to the site, the separation distance needs to be evaluated only for the larger container or the larger diked area.
4. When two of the same kind of containers of different sizes expose a site and the smaller container is closer to the site, the separation distance must be evaluated for both containers.
5. When both pressurized and unpressurized containers occupy a site, calculate the ASD for the container closest to the project (or the largest container) and always calculate the ASD for the pressurized container, regardless of its location.

The next step is to assemble information collected and proceed to determine the acceptable separation distance (ASD) between the proposed project site and the hazardous operation using the appropriate worksheets (nomographs). When using the worksheets (nomographs) always start on the horizontal axis and proceed by drawing a vertical line from the point on the

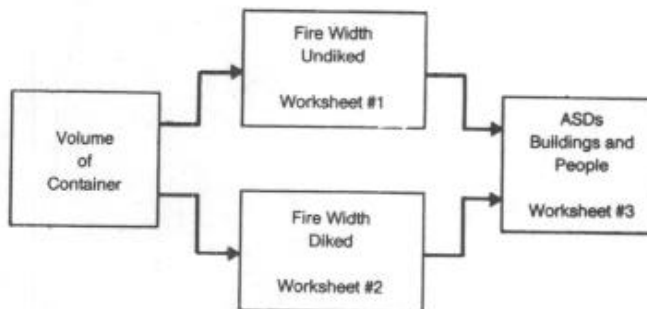
horizontal axis to the point of intersection with the straight line curve. Then, draw a horizontal line from that point where the lines cross to the left vertical axis.

Calculating ASDs for Fire

To calculate the ASD for a hazardous operation for fire, use either:

- Worksheet #1 Fire Width for Undiked Containers; or
- Worksheet #2 Fire Width for Diked Containers

To determine the specific ASD apply the values obtained from either Worksheet #1, or #2 to Worksheet #3 "Acceptable Separation Distance (Thermal Radiation)" (diked/undiked). Two calculations are to be made – one for buildings and one for people in unprotected outdoor areas. For selected size containers, many ASDs have been calculated and are found in Appendix F.



Calculating ASD for Explosion

To calculate the ASD for hazardous operation for explosion, use:

Worksheet #4 (blast overpressure for containers without blast barriers – 30,000 gallon capacity or more). Many ASDs have been calculated for selected size containers and are found in Appendix G.

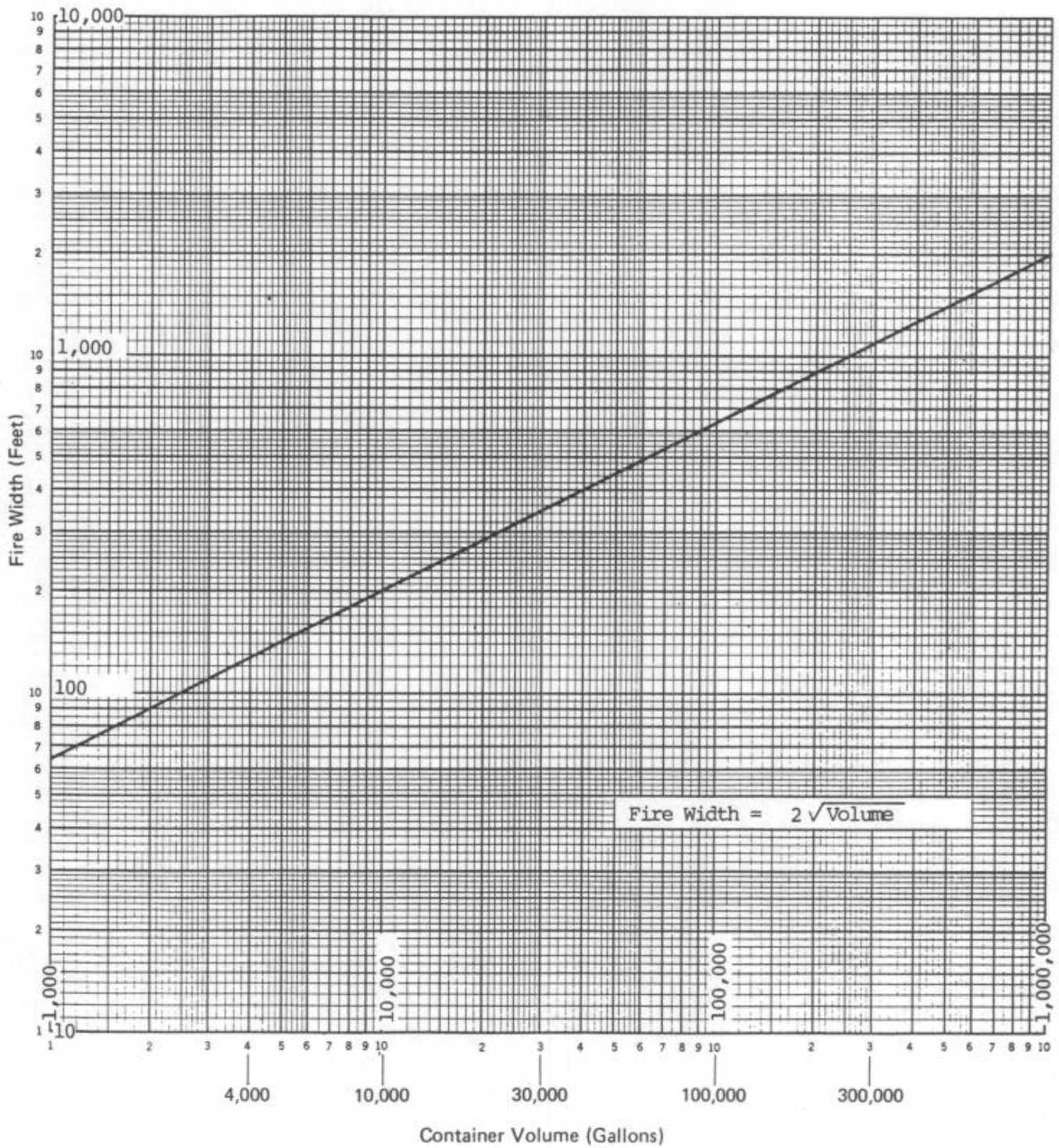


Acceptable Separation Distances

1. The hazard requiring the greatest separation distance, i.e. either fire or explosion will determine the ASD for the proposed project site.
2. If the acceptable separation distance (ASD) is less than the actual distance between the hazard and the project site, the actual separation distance is considered adequate.
3. If the ASD is greater than the actual distance, the actual distance is inadequate and must be increased to the ASD (acceptable separation distance) unless mitigating measures exist or are introduced.

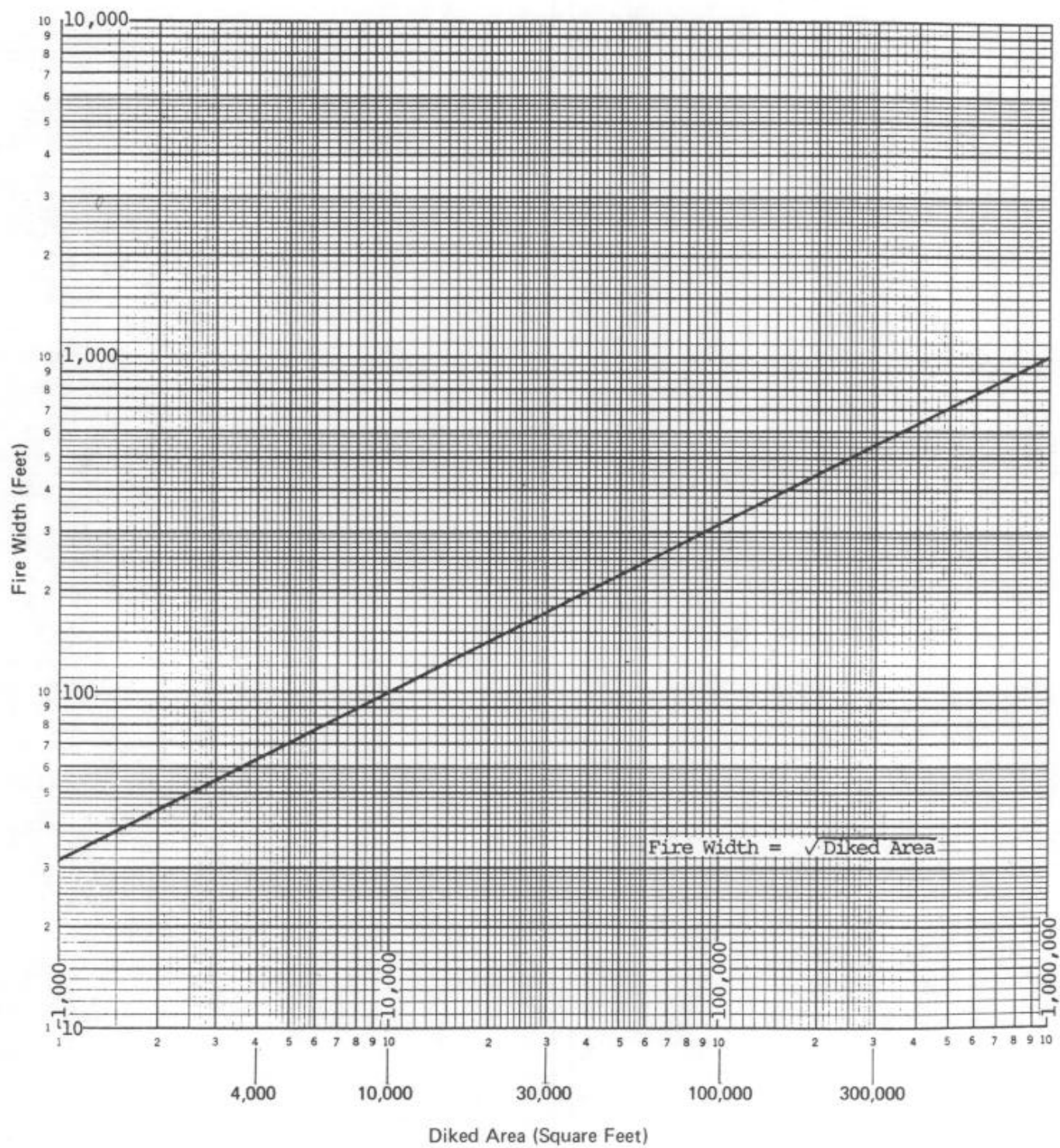
Worksheet No. 1

Undiked Fire Width
(Hazardous Liquid Container)



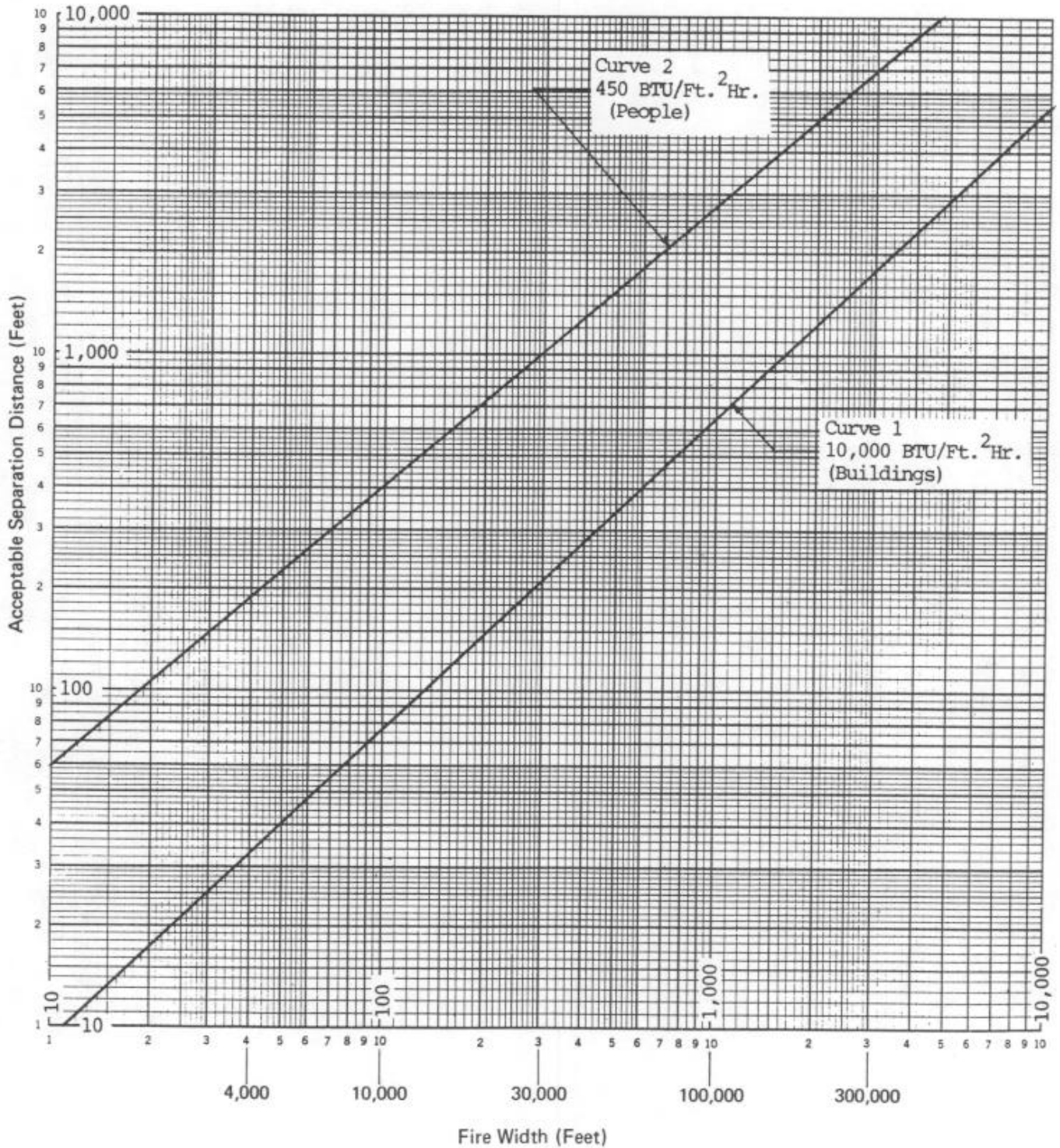
Worksheet No. 2

Diked Fire Width (Hazardous Liquid Container)



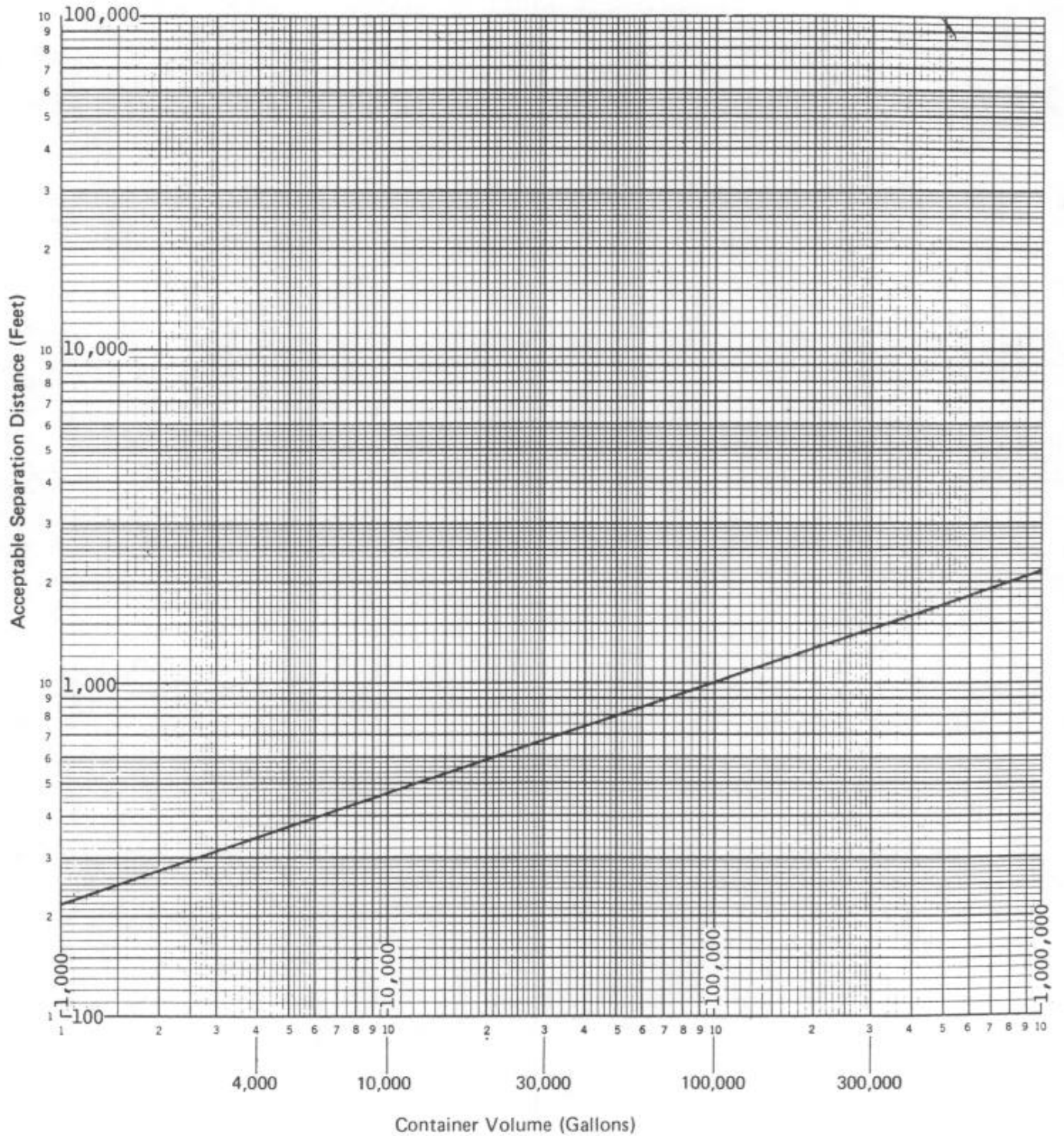
Worksheet No. 3

Acceptable Separation Distance (Thermal Radiation)

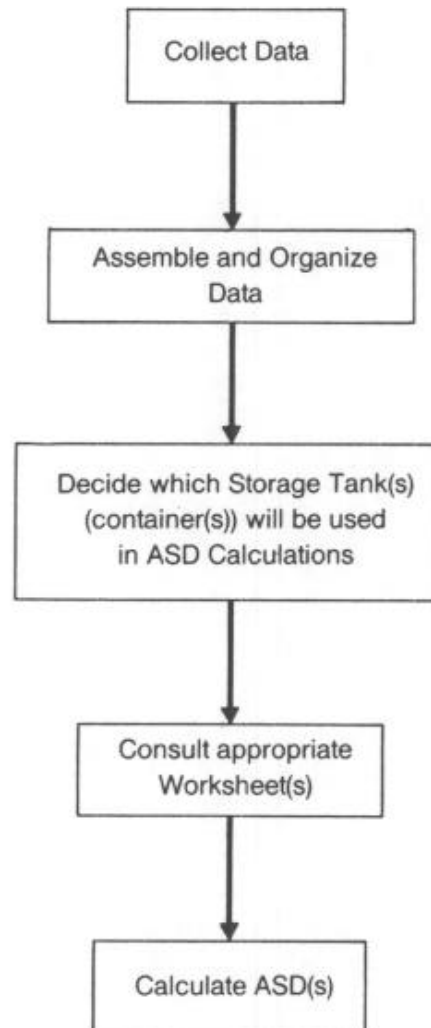


Worksheet No. 4

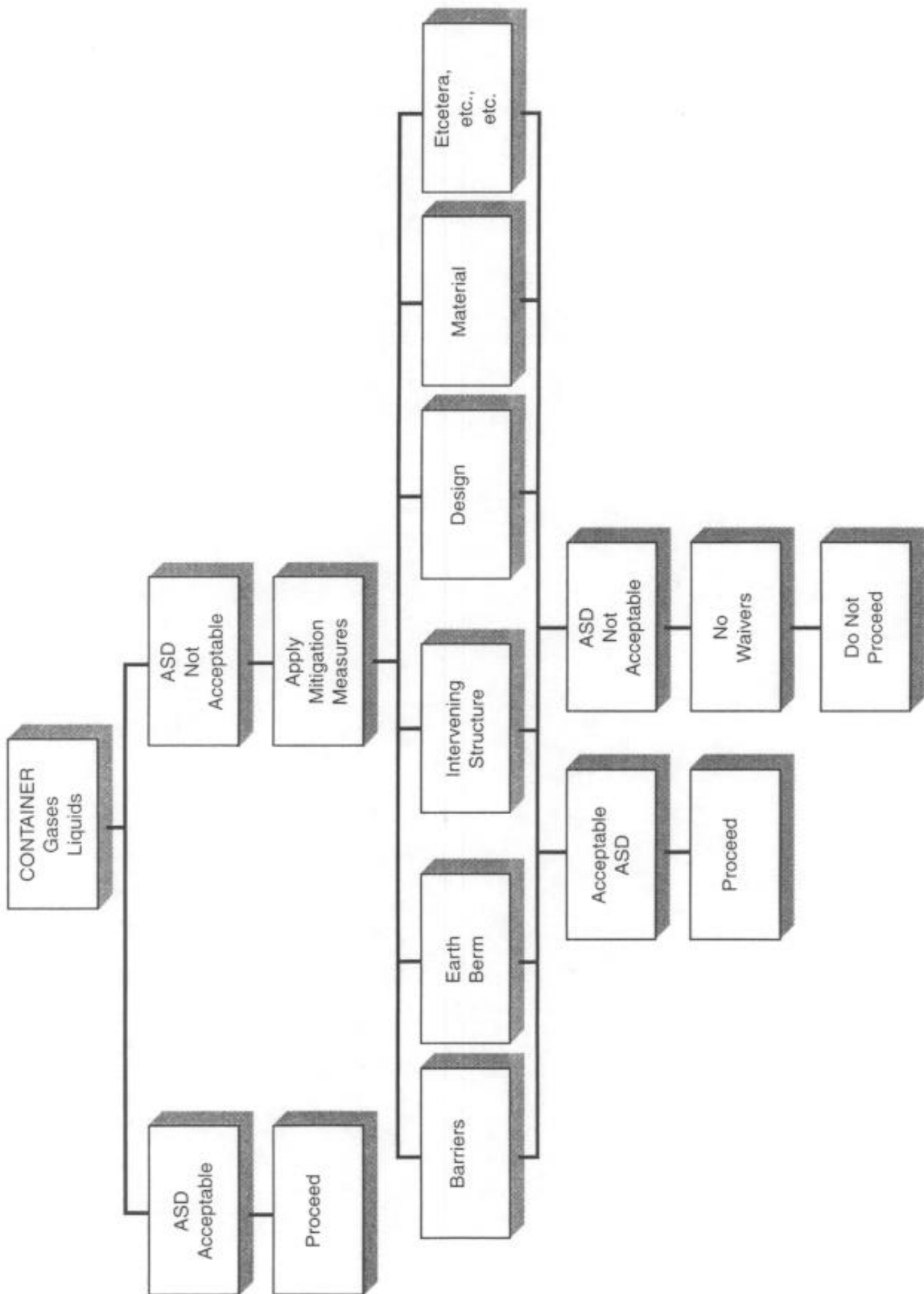
Acceptable Separation Distance
(Blast Overpressure)

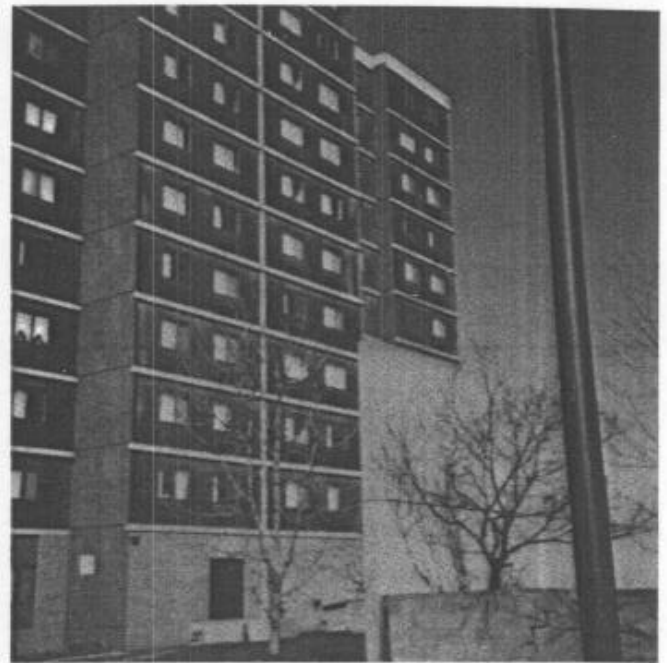
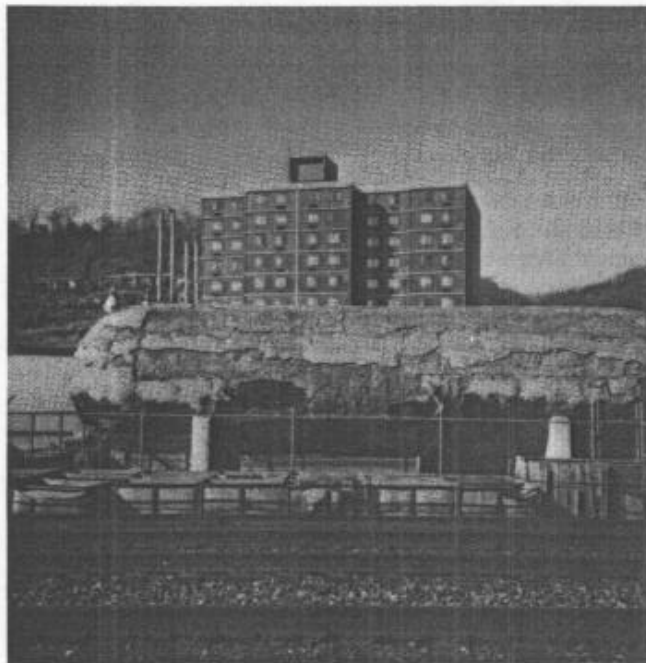


Summary of Site Analysis Steps



24 CFR 51C Decision Tree Proposed Site Selection





This housing project for the elderly in Sharpsburg, Pa. was approved when the sponsors agreed to construct a reinforced concrete 18 foot high wall to shield the building and its occupants. The wall was designed for this site as a mitigating measure for an unacceptable ASD for blast overpressure (explosion).

